OPERATING MANUAL

LAB (TTL)
DATA INTERFACE
OPERATING MANUAL
(MODEL 40204)

FIREBERD™

Telecommunications
Techniques
Corporation®

A DYNATECH COMPANY

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Rev. -

LAB (TTL)
DATA INTERFACE
OPERATING MANUAL
(MODEL 40204)

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GENERAL INFORMATION

1.1 INTRODUCTION

This manual contains information on Telecommunications Techniques Corporation's (TTC) Lab (TTL) Data Interface (Model 40204). This information is divided into sections on: general information; interface description, installation, and set-up; mainframe set-up; interface specifications; and service information.

1.2 OVERVIEW

The Lab Data Interface allows a FIREBERD mainframe to test a wide variety of data communications equipment and systems by converting TTL level signals used within the FIREBERD to either bipolar or unipolar format. The Lab Data Interface is capable of driving loads from 50 ohms to 8K ohms. This interface allows different clock relationships between the data and clock. In addition, the interface is capable of unbalanced or balanced operation in either unipolar or bipolar operating mode.

1.3 INTERFACE FEATURES

The Lab Data Interface has the following features.

- Provides user-selectable input impedances (50, 75, 100, and 8K ohms).
- Operates in either bipolar or unipolar mode.
- Provides choice of clock and data phasing.

1.4 INTERFACE COMPATIBILITY

The Lab Data Interface is functionally compatible with the following standards, but does not guarantee to meet all the parameters of each standard.

- RS-422A
- RS-423A
- RS-232-C
- MIL-188-114 Unbalanced
- MIL-188-114 Balanced

1.5 OPTIONS AND ACCESSORIES

The are no special cables available from TTC for this interface. BNC connectors (available from a variety of sources) provide the input and output connections for this interface.

INTERFACE DESCRIPTION

2.1 INTRODUCTION

The Lab Data Interface is controlled by the interface front panel. This section describes the interface connectors and controls, the interface functionals, and the timing sources.

2.2 PHYSICAL DESCRIPTION

The Lab Data Interface measures 7.3 inches (185 mm) wide, 1.5 inches (38 mm) high, and 5.1 inches (130 mm) deep. Two spring-tensioned screws secure the interface module to the FIREBERD Communications Analyzer rear panel. Connector pins on the interface module mate with the mainframe's connector receptacle when the interface panel is flush with the mainframe rear panel.

Three rotary switches provide the interface hardware controls. By setting these switch positions, up to 64 operating modes can be accommodated. The following paragraphs describe these interface controls.

INPUT IMP Switch - This four-position rotary switch selects the interface input impedance. The four input impedance values are: 50, 75, 100, and 8K ohms. This switch setting and the CLK PHASING switch setting are used together to provide functional compatibility with various data standards.

CLK PHASING Switch - This four-position rotary switch selects the data and clock phase relationships for both the transmitter and receiver. For both the transmitter and receiver sides, either falling-edge valid or rising-edge valid can be selected. This switch setting and the INPUT IMP switch are used to make the interface functionally compatible with various interface standards.

MODE Switch - This four-position rotary switch selects either the BIPOLAR or UNIPOLAR mode of operation. Whether in bipolar or unipolar, balanced or unbalanced format may be selected.

2.3 FUNCTIONAL DESCRIPTION

The Lab Data Interface is designed to convert between the TTL signals used within the FIREBERD mainframe and the user-selected signal type and format. Data generated by the FIREBERD is transmitted through the TX DATA connector. The synchronous transmitted clock signal is available at the TX CLK OUT connector. Data is fed to the FIREBERD

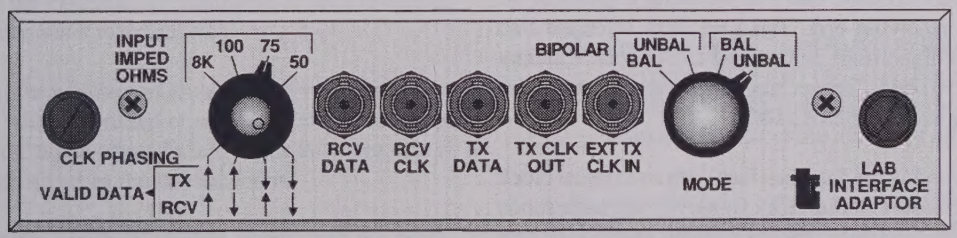


Figure 2-1
Lab Data Interface

for analysis through the RCV DATA connector and the synchronous received clock is sent through the RCV CLK connector.

2.3.1 Timing Sources

For the FIREBERD 6000, three transmit timing sources can be selected: (1) the clock received at the interface EXT TX CLK IN interface connector; (2) the synthesizer clock; or (3) the external BNC clock input. Selection of the timing source on the FIREBERD 6000 is made by pressing the front panel pushbutton switch labeled GEN CLK. Repeatedly pressing this pushbutton scrolls through its three selections (SYNTH, INTF, or BNC).

Selection of the timing source on the FIREBERD 4000 is made by pressing the SETUP CATEGORY rocker switch until the LED next to the GENERATOR CLOCK label is illuminated. The three softkey pushbutton switches above the SETUP panel are used to select the INTRNL, INTF, or BNC timing source.

2.3.2 Self-Loop

The self-loop test is not supported by this data interface.

2.4 APPLICATION INFORMATION

The following information is provided to aid in using the Lab Data Interface to its best advantage. The interface switches mentioned in the following paragraphs are described in detail in Section 3.

When operating at a high bit rate or when driving long cables, it is recommended that a terminating impedance be placed at the receiving end. The Lab Data Interface line drivers are low-impedance drivers and can operate with any load, down to 50 ohms. The terminating impedance serves to reduce ringing and cable crosstalk.

When supplying the data interface with an external clock input, ensure that the external clock signal is in the same mode (e.g., unipolar or unbalanced) as the transmit and receive data and clock signals.

When operating in the unipolar unbalanced mode with the INPUT IMPEDANCE switch set to 8K OHMS, the transmit and receive data and clock signals can be directly connected to any TTL family circuits. The data interface inputs and outputs are compatible with all TTL families (e.g., Schottky TTL, LS TTL).

When operating in the unipolar balanced mode with the INPUT IMPEDANCE switch set to either 8K OHMS or 100 OHMS and with CLOCK PHASING set to "⇓⇓", the data interface should be functionally compatible with RS-422A systems.*

When operating in the bipolar unbalanced mode with the INPUT IMPEDANCE switch set to 8K OHMS and CLOCK PHASING set to "⇓⇓", the data interface should be functionally compatible with RS-232C, RS-423A, or MIL-188-114 bipolar unbalanced systems.*

When operating in the bipolar balanced mode with the INPUT IMPEDANCE switch set to 100 OHMS and CLOCK PHASING set to "⇓⇓", the data interface should be functionally compatible with MIL-188-114 bipolar balanced, and with a pad on the outputs, V.35 systems.*

*Full compliance with the mentioned system parameters is not guaranteed.

INTERFACE INSTALLATION, SET-UP, AND OPERATION

3.1 INTRODUCTION

This section is divided into two major parts. Each part describes the interface installation, set-up, and operating procedures for the FIREBERD 6000 and FIREBERD 4000 mainframes, respectively. Refer to the appropriate FIREBERD mainframe User's Guide and Operating Manual for mainframe operating procedures and for additional information.

3.2 FIREBERD 6000

The following sections describe installation, set-up, and operation of this interface for the FIREBERD 6000 mainframe.

3.2.1 Interface Installation

The following procedure describes the steps for installing the interface into a FIREBERD 6000 mainframe.

CAUTION: Turn the AC power OFF before installing the interface module in the FIREBERD mainframe.

(1) Ensure that the POWER switch is in the OFF position on the FIREBERD mainframe front panel.

(2) Turn the FIREBERD mainframe around to expose the rear panel interface slot.

(3) Insert the interface module into the vacant interface slot, with the printed circuit (PC) board facing up. The PC board edges fit into slides on either side at the top edges of the interface slot.

(4) Press the interface module firmly into the mainframe mating connector, until the interface faceplate is flush with the mainframe rear panel.

(5) Secure the interface in the mainframe by turning the two screws on the interface front panel clockwise, until finger tight.

3.2.2 FIREBERD 6000 Mainframe Set-Up

The following steps outline the procedure for setting up the FIREBERD 6000 mainframe after the interface installation is complete.

(1) With the Lab Data Interface installed, turn the AC power on by pressing the front panel POWER switch to the ON position.

(2) If the FIREBERD is used in the TERM mode, connect the signal clock source to the interface panel RCV CLK connector and then connect the data source cable to the RCV DATA connector. If the FIREBERD is used as the clock source, a cable must be connected to the interface TX CLK OUT connector.

(3) Press the DATA pushbutton switch to select the desired data pattern. A data pattern is selected when the LED next to the data pattern label is illuminated. Refer to the FIREBERD 6000 User's Guide for a description of the different data patterns available and their uses.

(4) Press the GEN CLK pushbutton switch to select the signal timing source for use during the test (INTF, SYNTH, or BNC). Selecting the BNC signal timing source requires an external clock source from either the network or another source to be connected to the FIREBERD.

(5) Press the MENU pushbutton to illuminate the LED next to the INTF SETUP label. The message **INTERFACE: XXXXXX** is displayed on the top line and the available interfaces are displayed on the bottom line.

(6) Press the LAB softkey to select the Lab Data Interface. The display shows **INTERFACE: LAB** on the top line indicating that it has been selected.

(7) Press the MENU pushbutton switch to select other front panel controls (ANALYSIS RESULTS, ANALYSIS MODE, PRINTER, etc.) as required for the test to be performed.

3.2.3 Interface Set-Up

This section describes the interface selections available for the FIREBERD 6000 after the mainframe has been configured. The Lab Data Interface is selected through the FIREBERD 6000 front panel controls and is controlled through the interface panel rotary switches. The following paragraphs describe the interface panel switches, their functions, and selections.

INPUT IMPED Switch - This four-position rotary switch is used to select the input impedance for the RCV DATA, RCV CLK, and TX CLK IN connectors. The switch setting determines the input impedance placed across these three connectors. The input impedance selections are: 50, 75, 100, or 8K ohms. The 8K ohm position allows the input signals to be connected directly to the line receiver ICs without any other resistive termination.

CLK PHASING Switch - This four-position rotary switch is used to control the data and clock phase relationships for both the transmitter and receiver. The switch setting controls which edge (rising or falling) of the pulse is valid. This allows the interface to be used in a variety of different timing environments. Figure 3-1 illustrates the different clock phasing selections available and the resultant data/clock relationships. Figure 3-2 illustrates the voltage levels required at the RCV DATA, RCV CLK, and EXT TX CLK IN connectors for proper operation.

NOTE: The voltage levels required are independent of the input impedance.

MODE Switch - This four-position rotary switch controls the mode of operation for all five interface connectors. The switch position selects between BIPOLAR or UNIPOLAR and then either balanced (BAL) or unbalanced (UNBAL) for the selected mode. In bipolar mode, both the Mark and Space conditions are of opposite polarities, with respect to ground. In unipolar mode, the Mark and Space conditions are positive only with respect to ground. Selecting unbalanced for either mode ties the outer conductor to ground, and selecting balanced allows the outer conductor to be used as a complementing driver. Figure 3-3 illustrates the output voltage levels and the signal arrangements for each of the four MODE switch settings.

3.3 FIREBERD 4000

The following sections describe the installation, set-up, and operation of this interface in the FIREBERD 4000 mainframe.

3.3.1 Interface Installation

The following procedure describes the steps for installing the interface into a FIREBERD 4000 mainframe.

CAUTION: Turn the AC power OFF before installing the interface module in the FIREBERD mainframe.

(1) Ensure that the POWER switch, located on the rear panel, is in the OFF position on the FIREBERD mainframe.

(2) Turn the FIREBERD mainframe around to expose the rear panel interface slot(s). The FIREBERD 4000 may have two interface slots, if Option 4001 (optional interface) is installed. Slot 1 (the bottom slot) is standard and Slot 2 is the optional slot (the top slot).

(3) Insert the interface module into the vacant interface slot in the FIREBERD 4000 mainframe, with the printed circuit (PC) board facing up. The PC board edges fit into slides at the top edges of the interface slot.

(4) Press the interface module firmly into the mainframe mating connector, until the interface faceplate is flush with the mainframe rear panel.

(5) Secure the interface in the mainframe by turning the two screws on the interface front panel clockwise, until finger tight.

3.3.2 FIREBERD 4000 Mainframe Set-Up

The following steps outline the procedure for setting up the FIREBERD 4000 mainframe after the interface installation is complete.

(1) With the Lab Data Interface installed, turn the AC power on by pressing the rear panel POWER switch to the ON position.

(2) If the FIREBERD is used in the TERM mode, connect the signal clock source to the interface panel RCV CLK connector and then connect the data source cable to the RCV DATA connector. If the FIREBERD is used as the clock source, a cable must be connected to the interface TX CLK OUT connector.

(3) Press the PATTERN pushbutton switch to select the desired data pattern. The first three data patterns are visible on the bottom line of the display. Pressing the MORE pushbutton switch displays additional data

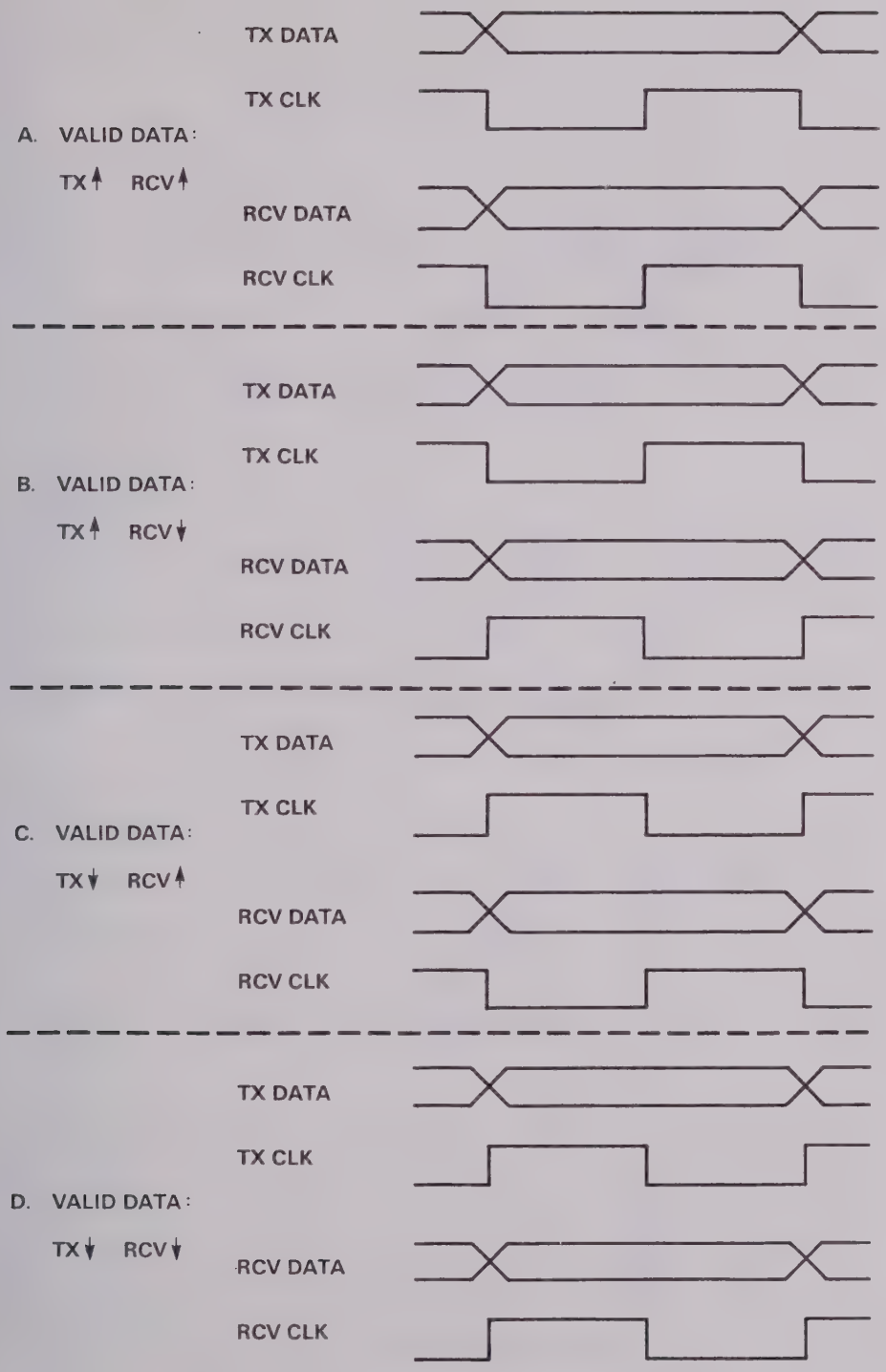
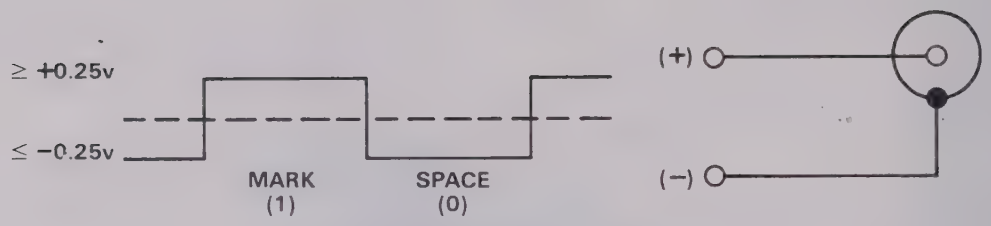
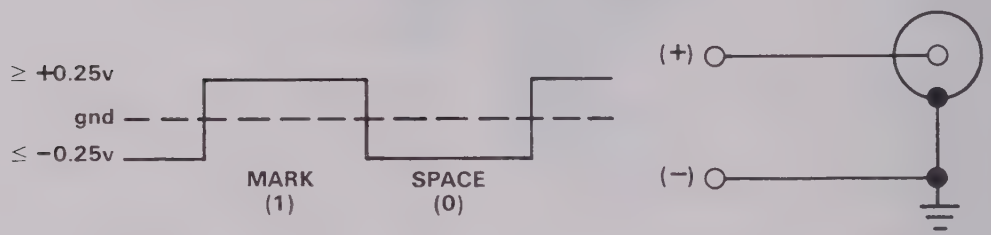


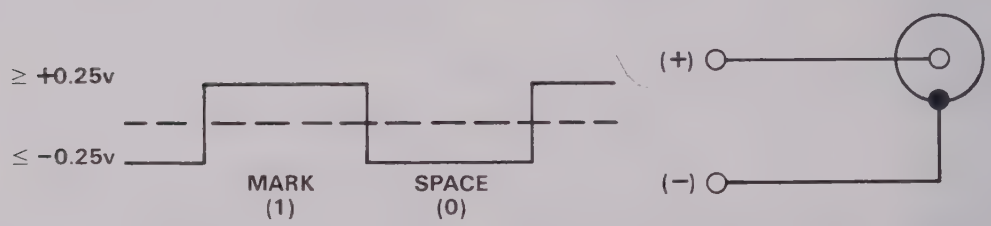
Figure 3-1
Clock Phasing Selections



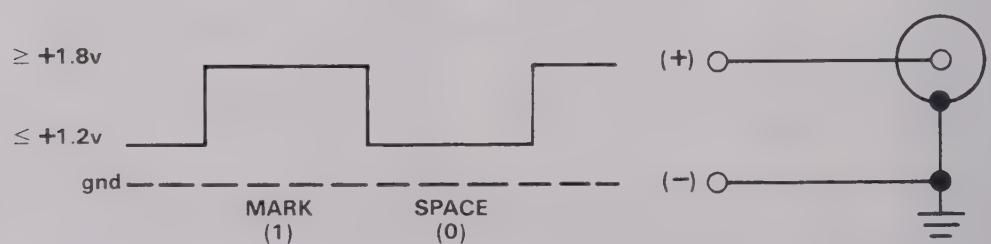
A. Bipolar Balanced (differential voltage)



B. Bipolar Unbalanced



C. Unipolar Balanced (differential voltage)



D. Unipolar Unbalanced

Figure 3-2
Minimum Required Input Levels for Each Operating Mode

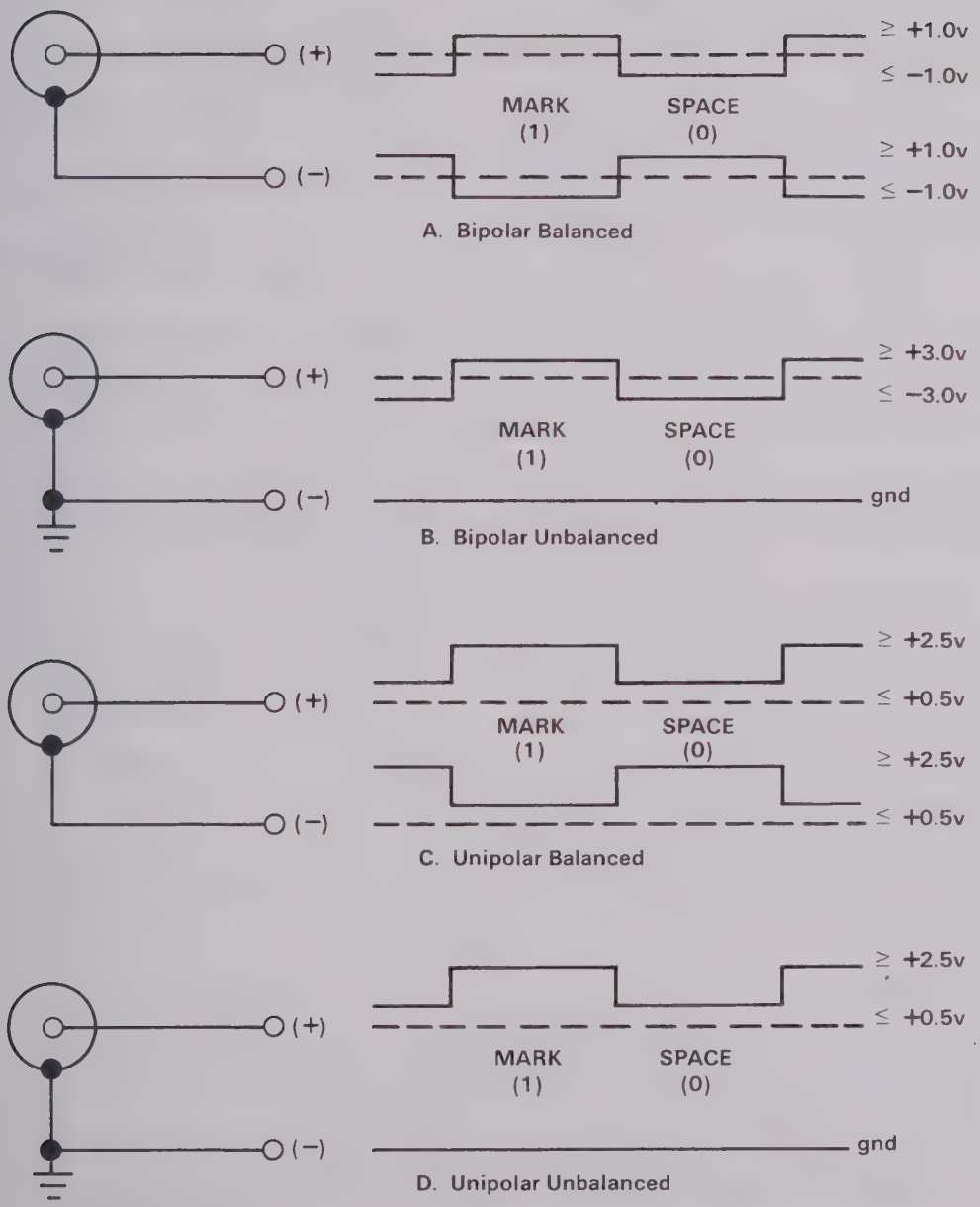


Figure 3-3
Selectable Operating Modes Transmit Data and Clock Outputs

patterns. Pressing the corresponding softkey selects that data pattern for transmission and reception. Refer to the FIREBERD 4000 User's Guide for a description of the different data patterns available and their uses.

(4) Press the SETUP CATEGORY rocker switch to illuminate the LED next to the label GENERATOR CLOCK to select the signal timing source for use during the test.

(5) The front panel displays **GEN CLOCK: XXXXXX** on the top line and the three choices on the bottom line. Selecting the BNC signal timing source requires an external clock source from either the network or another source.

(6) Press the SETUP CATEGORY rocker switch to illuminate the LED next to the INTERFACE label. The message **INTERFACE: XXXXXX** is displayed on the top line and a list of available interfaces is displayed on the bottom line.

(7) Press the LAB softkey to select the Lab Data Interface. Pressing this softkey displays **INTERFACE: LAB** on the top line.

(8) Press the SETUP CATEGORY rocker switch to set or verify other criteria required for the test to be performed. Pressing the SETUP CATEGORY rocker switch to illuminate the LED next to the SETUP SUMMARY label displays the selected test pattern, interface, and clock frequency.

(9) Set the other front panel controls (RESULT SELECT, CATEGORY, PRINTER, etc.) as required to configure the mainframe for the test to be performed.

3.3.3 Interface Set-Up

This section describes the interface selections available for the FIREBERD 4000 after the mainframe has been configured. The Lab Data Interface is selected through the FIREBERD 4000 front panel controls and is controlled by the interface rotary switches. The following paragraphs describe the interface panel switches, their function, and selections.

INPUT IMPED Switch - This four-position rotary switch is used to select the input impedance for the RCV DATA, RCV CLK, and TX CLK IN connectors. The switch setting determines the input impedance placed across these three connectors. The input impedance selections are: 50, 75, 100, or 8K ohms. The 8K ohm position allows the input signals to be connected directly to the line receiver ICs without any other resistive termination.

CLK PHASING Switch - This four-position rotary switch is used to control the data and clock phase relationships for both the transmitter and receiver. The switch setting controls which edge (rising or falling) of the pulse is valid. This allows the interface to be used in a variety of different timing environments. Figure 3-1 illustrates the different clock phasing selections available and the resultant data/clock relationships. Figure 3-2 illustrates the voltage levels required at the RCV DATA, RCV CLK, and EXT TX CLK IN connectors for proper operation.

NOTE: The voltage levels required are independent of the input impedance.

MODE Switch - This four-position rotary switch controls the mode of operation for all five of the interface connectors. The switch position selects between BIPOLAR or UNIPOLAR and then either balanced (BAL) or unbalanced (UNBAL) for the selected mode. In bipolar mode, both the Mark and Space conditions are of opposite polarities, with respect to ground. In unipolar mode, the Mark and Space conditions are positive only with respect to ground. Selecting unbalanced for either mode ties the outer conductor to ground and selecting balanced allows the outer conductor to be used as a complementing driver. Refer to Figure 3-3 for an illustration of the selectable operating modes and the different configurations.

INTERFACE SPECIFICATIONS

4.1 INTRODUCTION

This section contains the specifications for the Lab Data Interface. This information is listed in Table 4-1.

Table 4-1
Lab Data Interface Specifications

Item	Specification
Output Levels	
Bipolar Balanced:	±2.0V minimum differential voltage (+19.0 dBm, into 50 ohms) (+17.3 dBm, into 75 ohms).
Bipolar Unbalanced:	±3.0V minimum (+22.6 dBm minimum, into 50 ohms) (+20.8 dBm minimum, into 75 ohms).
Unipolar Balanced:	±2.0V minimum differential voltage (+19.0 dBm minimum, into 50 ohms) (+17.3 dBm minimum, into 75 ohms).
Unipolar Unbalanced	+2.5V minimum Mark (logic 1) +0.5V maximum Space (logic 0).
Input Levels	
Bipolar Balanced:	±0.25V minimum differential voltage (+1.0 dBm, into 50 ohms) (-0.5 dBm, into 75 ohms) ±12.0V maximum, with respect to FIREBERD ground.
Bipolar Unbalanced:	+0.25V minimum Mark (logic 1) -0.25V minimum Space (logic 0) (+1.0 dBm, into 50 ohms) (-0.5 dBm, into 75 ohms).
Unipolar Balanced:	± 0.25V minimum differential voltage (+1.0 dBm, into 50 ohms) (-0.5 dBm, into 75 ohms) ±12.0V maximum with respect to FIREBERD ground.
Unipolar Unbalanced:	+1.8V minimum Mark (logic 1) +1.2V maximum Space (logic 0).

Maximum Input Levels

The following voltage levels are not to be exceeded at any time (differential voltage for balanced operation and Vdc for unbalanced operation):

50 ohms	±3.3V (23.4 dBm).
75 ohms	±4.0V (23.3 dBm).
100 ohms	±4.7V (23.4 dBm).
8K ohms	±15.0V.

MAINTENANCE AND SERVICE

5.1 INTRODUCTION

This section contains information on maintenance and service for the Lab Data Interface, including TTC's warranty policies and repair procedures.

5.2 MAINTENANCE

5.2.1 In Case of Difficulty

If the unit totally fails to operate after installing the interface module, (i.e., no panel indicators light), check the following items:

- Verify that the supply line voltage is present.
- Verify that the AC line cord is supplying the line voltage to the mainframe.
- On the FIREBERD mainframe, verify the proper line voltage selection.
- On the FIREBERD mainframe, verify the fuse is not blown and that it is correct for the supplied line voltage.
- Verify the interface is properly seated into the mainframe.

If some of the indicators light but the unit fails to operate, verify that the interface installed is the correct type and that it is properly installed. Be sure to turn the mainframe power off before trying to remove or reseat the interface. If another interface module is available, turn off the power and substitute the other interface.

If troubles still persist, follow the self-test procedures in the FIREBERD Operating Manual as an aid in localizing the problem. If the mainframe continues to be inoperative, refer to the following sections for service information, or call the TTC Customer Service Department for assistance.

5.3 SERVICE

5.3.1 Warranty Policy

All equipment manufactured by Telecommunications Techniques Corporation (TTC) is warranted against defects in material and workmanship. This warranty applies only to the original purchaser and is non-transferable unless express written authorization of the warranty transfer is granted by TTC.

Data interfaces, accessories, cables, breakout boxes, and all equipment (other than FIREBERD mainframes) will be repaired or replaced (at our option), at no charge, for a period of one (1) year after shipment to the customer.

Liability under this warranty extends only to the replacement value of the equipment. This warranty is void if:

(1) Equipment has been altered or repaired without specific written authorization from TTC.

(2) Equipment is installed or operated other than in accordance with instructions contained in TTC literature and operating manuals.

No other warranty is expressed or implied. TTC is not liable for consequential damages.

5.3.2 In-Warranty Service

Equipment in warranty must be returned to the factory with shipping prepaid. The equipment should be packed and shipped in accordance with the instructions in Section 5.3.4 of this manual. Before returning any equipment, the customer must obtain a Return Authorization (RA) number by contacting the TTC Repair Department. The RA number should be included on all paperwork and be clearly marked on the outside of the shipping container.

After the equipment is repaired by TTC, it will be tested to applicable specifications, burned-in for at least 24 hours, retested, and returned to the customer with shipping prepaid. A brief description of the work performed and the materials used will be provided on the Equipment Repair Report that will be furnished with the returned equipment.

5.3.3 Out-of-Warranty Service

The procedure for repairing out-of-warranty equipment is the same as that used for equipment still in warranty. However, there is a minimum charge applied to each request for out-of-warranty service. The minimum charge guarantees the customer an estimate of the repair costs and is used as credit against actual materials and labor costs should the equipment

be repaired. Contact the TTC Repair Department for specific information on the minimum out-of-warranty repair charge.

The customer will be billed for parts and standard labor rates in effect at the time of repair. The customer will also be required to furnish a purchase order number before repair work can be started. A hard copy of the purchase order must be received by TTC before the repaired equipment can be shipped to the customer. A description of the materials used will be provided in the Equipment Repair Report.

Once an out-of-warranty repair is made, the repaired part or component is warranted for 90 days. This warranty applies only to the part or component that was repaired; other parts or components are not covered under the 90-day repair warranty.

5.3.4 Equipment Return Instructions

To all equipment returned for repair, the customer should attach a tag that includes the following information.

(1) Owner's name and address.

(2) A list of equipment being returned and the corresponding serial number(s).

(3) A detailed description of the problem or of the service requested.

(4) The name and telephone number of the person to contact regarding questions concerning the repair(s).

(5) The Return Authorization (RA) number.

If possible, the customer should return the equipment in the original shipping container and material. If the original container is not available, the unit should be carefully packaged so that it will not be damaged in transit. TTC is not liable for any damage that occurs during shipment. The customer should clearly mark the TTC-issued RA number on the outside of the package and ship it prepaid and insured to TTC.

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